

CLAIMS

What is claimed is:

- 1 1. A method comprising:
2 accessing a first multi-dimensional graphical matrix representation that
3 describes the appearance of a plurality of points of an object from a plurality of
4 viewing directions, the appearance varying from point to point and viewing direction
5 to viewing direction;
6 creating a second graphical representation that approximates the first graphical
7 representation and that includes at least one expression having a fewer dimensions
8 than the first multi-dimensional graphical representation by decomposing the first
9 multi-dimensional graphical representation into the second graphical representation,
10 the decomposing including sign consistent matrix factorization to selectively represent
11 information from the first graphical representation.
- 1 2. The method of claim 1, wherein the sign consistent matrix factorization
2 comprises non-negative matrix factorization.
- 1 3. The method of claim 1, wherein the sign consistent matrix factorization
2 comprises alternating sign matrix factorization.
- 1 4. The method of claim 1, further comprising:
2 accessing a third multi-dimensional graphical representation that describes the
3 appearance of a second plurality of points of the object from a plurality of viewing
4 directions, the second plurality of points including the first plurality of points, and the
5 appearance varying from point to point and viewing direction to viewing direction;
6 and
7 partitioning the third multi-dimensional graphical representation into a
8 plurality of smaller multi-dimensional graphical representations each associated with a

9 primitive of a polygonal representation of the geometry of the object, the plurality of
10 smaller multi-dimensional graphical representations including the first multi-
11 dimensional graphical representation.

1 5. A machine-readable medium having stored thereon data representing
2 sequences of instructions that when executed cause a machine to perform operations
3 comprising:

1 access of a first multi-dimensional graphical matrix representation that
2 describes the appearance of a plurality of points of an object from a plurality of
3 viewing directions, the appearance varying from point to point and viewing direction
4 to viewing direction;

5 creation of a second graphical representation that approximates the first
6 graphical representation and that includes at least one expression having a fewer
7 dimensions than the first multi-dimensional graphical representation by decomposing
8 the first multi-dimensional graphical representation into the second graphical
9 representation, the decomposing including sign consistent matrix factorization to
10 selectively represent information from the first graphical representation.
11

12 6. A machine-readable medium of claim 5 having stored thereon data
13 representing sequences of instructions that when executed cause a machine to perform
14 operations comprising a non-negative matrix factorization when performing the sign
15 consistent matrix factorization.

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17 7. A machine-readable medium of claim 5 having stored thereon data
18 representing sequences of instructions that when executed cause a machine to perform

22 8. A machine-readable medium of claim 5 having stored thereon data
23 representing sequences of instructions that when executed cause a machine to perform
24 operations comprising

access of a third multi-dimensional graphical representation that describes the appearance of a second plurality of points of the object from a plurality of viewing directions, the second plurality of points including the first plurality of points, and the appearance varying from point to point and viewing direction to viewing direction; and

partition of the third multi-dimensional graphical representation into a plurality of smaller multi-dimensional graphical representations each associated with a primitive of a polygonal representation of the geometry of the object, the plurality of smaller multi-dimensional graphical representations including the first multi-dimensional graphical representation.

9. A data structure comprising

at least a first portion and a second portion, the second portion including a second plurality of view-dependent subportions including a first view-dependent matrix that corresponds to a first viewing direction and a second view-dependent matrix that corresponds to a second viewing direction, wherein the first portion and the first view-dependent subportion are combinable using multitexturing hardware that allows multiple textures to be concurrently applied to a primitive in a single rendering pass to display a plurality of points of an object with a first appearance corresponding to a first viewing direction, and wherein the first portion and the second view-

10 dependent subportion are linearly combinable using the multitexturing hardware and a
11 sign consistent matrix factorization to display the plurality of points of the object with
12 a second appearance corresponding to a second viewing direction.

1 10. The data structure of claim 9, wherein the data structure is derived from a
2 plurality of images acquired for the object by selectively representing information
3 from the plurality of images that is important to describe the appearance of the object
4 and selectively removing information from the plurality of images that is redundant.

1 11. The data structure of claim 9, wherein the first portion and the first view-
2 dependent subportion are combinable without decompression using the multitexturing
3 hardware.

1 12. The data structure of claim 9, wherein the first portion and the second portion
2 are created by decompressing a corresponding compressed first portion and a
3 corresponding compressed second portion of another data structure.

1 13. A system comprising
2 a hardware module that accesses a first multi-dimensional graphical matrix
3 representation that describes the appearance of a plurality of points of an object from a
4 plurality of viewing directions, the appearance varying from point to point and
5 viewing direction to viewing direction;
6 a matrix multiplication module in the hardware module that computes a second
7 graphical representation that approximates the first graphical representation and that
8 includes at least one expression having a fewer dimensions than the first multi-
9 dimensional graphical representation by decomposing the first multi-dimensional
10 graphical representation into the second graphical representation, the decomposing
11 including sign consistent matrix factorization to selectively represent information from
12 the first graphical representation.

1 14. The system of claim 13, wherein the sign consistent matrix factorization
2 comprises non-negative matrix factorization.

1 15. The system of claim 13, wherein the sign consistent matrix factorization
2 comprises alternating sign matrix factorization.

1 16. The system of claim 1, further comprising:
2 a submodule of the hardware module that accesses a third multi-dimensional
3 graphical representation that describes the appearance of a second plurality of points
4 of the object from a plurality of viewing directions, the second plurality of points
5 including the first plurality of points, and the appearance varying from point to point
6 and viewing direction to viewing direction; and further partitions the third multi-
7 dimensional graphical representation into a plurality of smaller multi-dimensional
8 graphical representations each associated with a primitive of a polygonal
9 representation of the geometry of the object, the plurality of smaller multi-dimensional
10 graphical representations including the first multi-dimensional graphical
11 representation.